Int. J. Electrochem. Sci., 12 **(2017)** 5742 – 5755

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Corrosion Mechanism of Steels in MDEA Solution and Material Selection of the Desulfurizing Equipment

Tan Sizhou[1], *Xiao Guoqing*[1,2], *Ambrish Singh*[3,4,*], *Shang Jianfeng*[5], *Long Decai*[1], *Zhang Naiyan*[3], *Zeng Dezhi*[3], *Eno E. Ebenso*[6]

[1]College of Chemical Engineering, Southwest Petroleum University, Chengdu-610500, China
[2]Key Laboratory of Oil and Gas Fire Protection of Sichuan Province
[3]State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu, 610500 China
[4]School of Materials Science and Engineering, Southwest Petroleum University, Chengdu-610500, China.
[5]Zhongyuan Oilfield Company, Sinopec, Puyang, 457001, China
[6]Department of Chemistry, School of Mathematical & Physical Sciences, North-West University(Mafikeng Campus), Private Bag X2046, Mmabatho 2735, South Africa.
[*]E-mail: vishisingh4uall@gmail.com; drambrishsingh@gmail.com

doi: 10.20964/2017.06.27

Received: 9 May 2016 / *Accepted:* 30 March 2017 / *Published:* 12 May 2017

In the present study, the corrosion properties of three steel were evaluated in 45 wt.% Methyldiethanolamine (MDEA) solution, saturated to the hydrogen sulfide (H_2S) and carbon dioxide (CO_2) as in the oilfields. Corrosion tests were performed using dynamic high temperature (HT) autoclave for various temperature conditions. Corrosion behavior of steels was monitored using electrochemical methods (Tafel polarization and Electrochemical Impedance Spectroscopy). Indoor autoclave loss tests showed that at a lower temperature (40°C ~ 60°C), corrosion rate of 20#, 304L and 316L are low, but increased significantly as the temperature rises. Electrochemical studies suggested that in the MDEA desulfuration solution containing H_2S / CO_2, 20 #, 304L and 316L steels are mainly susceptible to H_2S corrosion. With the increase in temperature, the corrosion potentials of the three steels shift negatively, the charge transfer resistance decreases, which accelerate the metal anode dissolution rate significantly.

Keywords: MDEA; Steel; EIS; Polarization; XRD; SEM

FULL TEXT